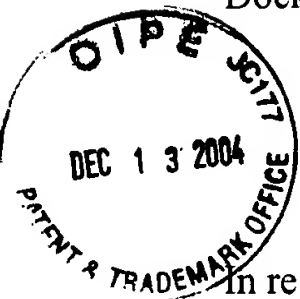


AF/1763  
IFW

Docket No.: 50090-301

PATENT



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of

Toshihiro YAMASHITA, et al.

Application No.: 09/901,038

Filed: July 10, 2001

Customer Number: 20277

Confirmation Number: 6404

Group Art Unit: 1763

Examiner: A. Crowell

For: PLASMA PROCESSING SYSTEM IN WHICH WAFER IS RETAINED BY  
ELECTROSTATIC CHUCK, PLASMA PROCESSING METHOD AND METHOD OF  
MANUFACTURING SEMICONDUCTOR DEVICE

**REPLY BRIEF**

Mail Stop Appeal Brief – Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22202

Sir:

This Reply Brief is submitted under 37 C.F.R. § 41.41 in response to the EXAMINER'S  
ANSWER dated October 19, 2004.

The Examiner's response to Appellants' arguments submitted in the Appeal Brief of  
August 3, 2004, raises additional issues and underscores the factual and legal shortcomings in the  
Examiner's rejections. In response, Appellants rely upon the arguments presented in the Appeal  
Brief of August 3, 2004, and the arguments set forth below.

The Examiner's response to the arguments presented by Appellants in the Appeal Brief of  
August 3, 2004, are found on pages 10-14 of the Examiner's Answer. In the first paragraph on page

10 of the Examiner's Answer, Appellants note that the Examiner has committed legal error in misinterpreting claim 1. In particular, the Examiner stated:

It should be noted that claim 1 simply requires a detection apparatus for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate. The claim does not positively recite and require that the detection apparatus detects impedance. It simply states variations in impedance arise between the sample table and the substrate.

However, claim 1 does recite "a detection apparatus for detecting ... and for detecting ... on the basis of variations in impedance arising between the sample table and the substrate" (emphasis added). Thus, claim 1 specifically requires the use of an impedance detection circuit to measure impedance. Clearly, one having ordinary skill in the art would recognize that detection apparatus recited in claim 1 operates on the basis of (i.e., measures) impedance.

The comments in the paragraph spanning pages 10 and 11 of the Examiner's Answer evidence a fundamental misunderstanding of how impedance is measured and the role of voltage during this measurement. For example, the Examiner cited a specific passage in Appellants' specification and stated "a voltage probe is used to measure impedance." There is a profound difference between the statements (i) "a voltage probe is used to measure impedance" (as found in Appellants' specification) and (ii) "a voltage probe measures impedance" (as asserted by the Examiner). In the first statement, the voltage probe is only described as being one part of the whole apparatus used to measure impedance. In the second statement, the voltage probe is being asserted as all that is necessary to measure impedance.

The reason why the first statement is correct and the second statement is not correct lies in how impedance is calculated. The Examiner cited Burns for the proposition that "impedance equal voltage divided by current (impedance= $V/I$ ) (see Burns article-Impedance Measurements)." By relying only on certain portion of Burns and ignoring others, the Examiner has put forth an oversimplified explanation as to how impedance is calculated.

Impedance is a comprehensive expression of any and all forms of opposition to electron flow, including both resistance and reactance. It is present in all circuits, and in all components. When alternating current goes through an impedance, a voltage drop is produced that is somewhere between  $0^\circ$  and  $90^\circ$  out of phase with the current. Impedance is mathematically symbolized by the letter "Z" and is measured in the unit of ohms ( $\Omega$ ), in complex (vector) sum of ("real") resistance (R) and ("imaginary") reactance (X).

When comparing the above definition to the teachings of Burns, Appellants note that in the first paragraph of the article, Burns states "[a]s the discussion in this chapter is related to DC, inductors and capacitors have zero reactance, and as such, make no contribution to impedance. Hence, impedance and resistance refer the same quantity at DC." Burns goes further on to state that "[i]f the input voltage is a linear function of input current ... then one simply forces a voltage V and measure a current I, or vice-versa and computes the input impedance according to  $Z_{in} = (V/I)$  Eqn. 3-3." Thus, the simple equation (i.e., impedance =  $V/I$ ) described by the Examiner is based under the assumption that AC is not used and under the assumption that input voltage is a linear function of input current.

Further restrictions to the simple equation used by the Examiner are described by Burns with reference to Figs. 3-9(a), 3-9(b). Although Fig. 3-9(a) satisfies Ohms law (i.e.,  $R = V/I$ ), Burns refers to Fig. 3-9(b) and states that there are certain circumstances (e.g., input terminal biased by a constant current source) in which "one cannot use Eqn. (3.3) to compute the input impedance, as it will not lead correctly to the slope of the i-v characteristic." Instead, Burns states that "one measure the change in the input current ( $\Delta I$ ) that results from a change in the input voltage ( $\Delta V$ ) and computes the input impedance using  $Z_{in} = (\Delta V / \Delta I)$  Eqn. 3-4."

As evident by all the assumptions that Burns places on the equation  $Z_{in} = (V/I)$  and by the alternative equations disclosed by Burns that may be needed to calculate impedance depending upon certain factors, it is readily apparent that measuring impedance is not nearly as simple and straightforward as asserted by the Examiner. Instead, measuring impedance is a complex process, in which measurement of voltage is but one factor, and may require measuring the phase of the voltage as it relates to the current, in addition to measuring the change in voltage and change in current. The Examiner, however, has failed to establish that the voltage measuring devices of Akihiro, Deguchi, and Sotozono teach or suggest capabilities of performing these types of measurements. For example, none of Akihiro, Deguchi, and Sotozono teach or suggest measuring change in current ( $\Delta I$ ) and change in voltage ( $\Delta V$ ) and using these measurements to calculate impedance.

Since the Examiner has not factually established that the conditions employed by Burns in which the simplistic equation of  $Z = (V/I)$  are inherently present within the applied prior art, one skilled in the art would understand that more complicated measurements are needed to obtain impedance. Furthermore, even if the Examiner could establish that measuring impedance could

be achieved with the simplistic equation of  $Z = (V/I)$ , it may be asserted that the detection devices of Akihiro, Deguchi, and Sotozono measure voltage. But that does not mean the detection devices of Akihiro, Deguchi, and Sotozono (i) use measured voltage and measured current, (ii) calculate measured voltage over measured current for multiple readings to obtain multiple calculated impedance readings, and (iii) compare the multiple calculated impedance readings to determine if "variations in impedance [arise]," as recited in claim 1.

Moreover, one having ordinary skill in the art would understand not to have employed the simplistic equation disclosed by Burns and relied upon by the Examiner in a plasma processing system, because a plasma processing system operates on the basis of both DC and AC power. For example, in column 5, lines 16-19 of Deguchi, a 13.56 MHz high frequency power supply 11 is described, and in column 5, line 40 of Collins, a RF generator 104 is described. Sotozono (e.g., RF power source 10) and Akihiro (e.g., RF power supply 15) also describe an AC power source. Furthermore, Appellants' specification also discusses the use of a high-frequency power supply 5. Therefore, it is apparent that the systems used by the applied prior art use both DC and AC power. Since, as discussed above, the impedance equation disclosed by Burns and relied upon the Examiner assumes that AC power is not used, the Examiner cannot rely on the impedance equation disclosed by Burns.

To address additional factual inaccuracies raised by the Examiner, Appellants note that in the first full paragraph on page 11 of the Examiner's Answer, the Examiner made the following statement:

Appellant [sic] has argued that there is no evidence introduced by the Examiner that would support a finding that current can always be assumed to be constant or that one having ordinary skill in the art would recognize that this feature is necessarily present in the prior art. However, whether the current

changes or the voltage changes, the end result is a change in the impedance since voltage and current determine impedance.

This statement is in response to an argument made by Appellants on page 6 of the Appeal Brief that a variation in voltage does not necessarily always equate to a variation in impedance, and therefore, a detection apparatus operating on the basis of variations in impedance (as claimed) can produce very different results from a detection apparatus operation on the basis of variations in voltage (as disclosed by the applied prior art).

The above-reproduced generalized statements by the Examiner ignore the fact that if voltage and current change at the same rate, there is no change in impedance. Alternatively, if current changes and voltage does not, then a change in impedance is not reflected by a change in voltage. Therefore, the Examiner cannot generalize that a detection device operating on the basis of change in voltage inherently, i.e., necessarily, also operates on the basis of change in impedance, since voltage change can occur without impedance change (and vice-versa). The doctrine inherency requires that the missing limitation (i.e., a detection device operating on the basis of impedance change) must necessarily be present by the disclosed device (i.e., a detection device operating on the basis of voltage change).

With regard to the paragraph spanning pages 11 and 12, in which the Examiner stated that when "voltage and current are detected, the impedance can be measured" (emphasis added) Appellants' note the use of the word "can." The Examiner does not (and cannot) assert that impedance is measured by the detection device of Deguchi. It should also be noted the Examiner does not assert Deguchi that teaches using the measured voltage and current in such a manner that impedance is derived and differences in different measurements of impedance are used. Instead,

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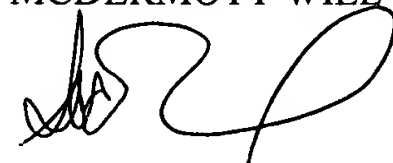
the Examiner only asserts that detection device of Deguchi is capable of measuring impedance. Notwithstanding that Deguchi may be capable of measuring certain parameters necessary to determine impedance (as noted above, if  $\Delta I$  and  $\Delta V$  are required to determine impedance, then measurement of just current  $I$  and voltage  $V$  is not enough), claim 1 requires that the detection device operates on the basis of changes in impedance.

For the reasons set forth in the Appeal Brief of August 3, 2004, and for those set forth herein, Appellants respectfully solicit the Honorable Board to reverse the Examiner's rejections under 35 U.S.C. §§ 101, 103.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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